'Nanoporous' material gobbles up hydrogen fuel

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Hydrogen-powered cars could one day store fuel safely and efficiently using polymers filed with nanoscopic holes.

Researchers have achieved a new record for absorbing hydrogen using such "nanoporous" polymers. Frantisek Svec at the Lawrence Berkeley National Laboratory, California, and Jean Fréchet, at the University of California in Berkeley, both in the US, revealed the feat at the International Congress of Nanotechnology, held in San Francisco between 30 October and 2 November.

Hydrogen is tipped as a fuel of the future, as it can by used to generate electricity cleanly, generating only water as waste. However, it must normally be stored as a liquid, under extreme pressure, which makes it expensive to process and dangerous to handle.

So the hunt is on to find a storage medium that will absorb hydrogen readily and could, in future, be used to transport it cheaply and safely. This could be used inside a vehicle's fuel tank and within containers used to transport hydrogen around the country.

Absorption target

The US Department of Energy (DoE) has set a target of finding materials capable of holding enough hydrogen to make up 6% of its own total mass by 2010. But these must also release hydrogen rapidly if it is to be used to refuel vehicles.

Svec and Fréchet created nanoporous polymers by heating and chemically treating styrene - an abundant hydrocarbon used to manufacture some plastics. The resulting material has an abundance of pores, each less than 2 nanometres in diameter.

Hydrogen atoms naturally stick to the polymer, when cooled to around 77 Kelvin (-196°C), by forming surface bonds. This allows them to pack tightly inside the material's pores. The material then releases the hydrogen when the temperature is raised or the pressure is reduced.

Naturally occurring

Svec and Fréchet found that at roughly 40 times atmospheric pressure, the nanoporous polymers contained 3.8% hydrogen. And, at atmospheric pressure, they contained 1.5% hydrogen. While this is still short of the DoE's target, it is the best achieved so far for such a material, and the team is working on improving the technique.

The researchers add that nanoporous polymers should also be far cheaper to produce than other materials currently being considered, such as carbon nanotubes, as they can be made simply using

existing manufacturing techniques.

Neil McKeown, a researcher at the University of Cardiff, UK, who is also experimenting with polymer storage mediums, says they hold great promise for the future. "What is good about polymers is that you can tweak their chemistry to modify their absorption," he told **New Scientist**.

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